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TD-04-060

SR02 Test Summary Report

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1. Introduction

The LN₂ pre cooling of the SR02 started on May 28th. The final cool down with LHe was finished on June 7th and the test started the 8th. The last step of the test (RRR) was finished on June 17th.

2. Quench History

The first quench was at 17010A with the nominal ramp rate of 20A/sec and a temperature of 4.5K. The magnet exhibited very slow training and even after 29 quenches it didn't reach a stable plateau. The next step was to study ramp rate dependence. We took seven quenches. No significant ramp rate dependence was observed until 175 A/s. At ramp rate higher than 175A/sec the magnet showed a 'sharp' drop of the quench current. We performed another 11 quenches with the nominal ramp rate and 2 with higher ramp rate to make an attempt to complete the magnet training. The maximum current was 20208A.

As shown in fig. 3. the magnet did not reached its critical current value. The short sample limit should have been around 25000 A.

In order to investigate the magnet behavior at lower temperature the magnet was cooled down to 2.2K and 11 quenches were performed at 20A/sec. At this temperature the average quench current was even lower than that of at 4.5T.

Other 4 quenches were then completed at 4.5T and those confirmed that no further training was observed..

The quench history plot is presented in fig 1. while in tab. 1 are shown the quench locations and the quench starting times. The voltage tap positions on the coil are illustrated in fig. 2.

Quench History

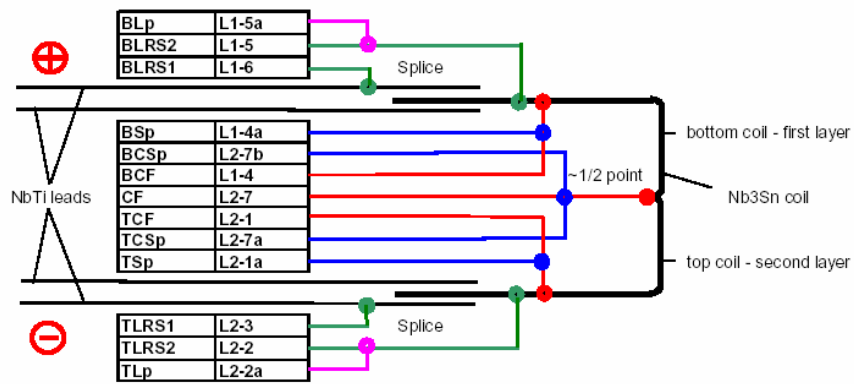
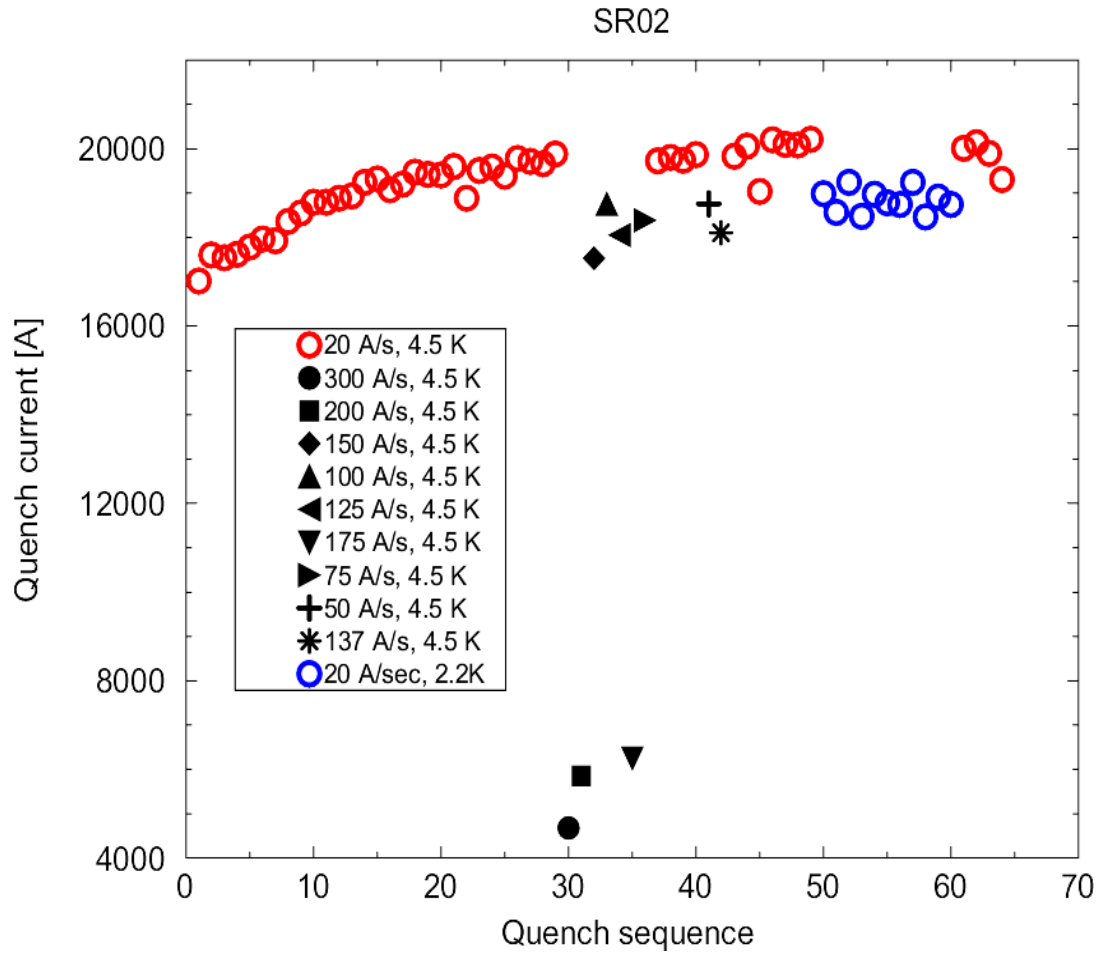


Figure 2. Voltage Tap position

Table 1. Quench History

File	Current	dIdt	tquench	MITs	QDC	1st VTseg	trise	CgDeMaBotL_1	Comment
sr02.Quench.040607101801.500	11	0	-0.0078	0.16	SIWcoil	QTLRS2_QBLRS2	0.0246	4.550	Nothing
sr02.Quench.040607104727.992	915	19	0.0000	0.07	WcoilGnd	QTLRS2_QBLRS2	-0.0003	4.548	QD leads trip
sr02.Quench.040608103143.451	5009	0	-0.6241	16.37	HcoilHcoil	QTLRS1_QTLRS2	0.0280	4.485	100A spot heater initiated quench
sr02.Quench.040608111109.496	17084	20	-0.0122	9.91	HcoilHcoil	QTLRS2_QBLRS2	-0.0038	4.487	Quench at 20A/sec, 4.5K, Iq=17010A
sr02.Quench.040608114151.671	17682	20	-0.0049	8.21	HcoilHcoil	QTLRS2_QBLRS2	-0.0034	4.491	Quench, 20A/sec, 4.5K, Iq=17598A
sr02.Quench.040608130215.737	17628	20	-0.0064	8.67	HcoilHcoil	QTLRS2_QBLRS2	-0.0032	4.487	Quench, 17537A, 4.5K, 20A/s
sr02.Quench.040608132456.042	17717	20	-0.0052	8.39	HcoilHcoil	QTLRS2_QBLRS2	-0.0032	4.502	Quench, Iq=17619A, 20A/sec, 4.5K
sr02.Quench.040608135426.043	17855	19	-0.0365	18.42	HcoilHcoil	QTLRS2_QBLRS2	-0.0035	4.507	Quench, Iq=17780A, 20A/sec, 4.5K
sr02.Quench.040608141728.489	18043	20	-0.0185	12.89	WcoilGnd	QTLRS2_QBLRS2	-0.0022	4.514	Quench, Iq=17961A, 20A/sec, 4.5K
sr02.Quench.040608143846.621	18016	20	-0.1388	51.80	HcoilHcoil	QTLRS2_QBLRS2	-0.0028	4.516	Quench, Iq=17926A, 20A/sec, 4.5K
sr02.Quench.040608151115.510	18448	21	-0.0046	8.64	HcoilHcoil	QTLRS2_QBLRS2	-0.0025	4.510	Quench, Iq=18353A, 20A/sec, 4.5K
sr02.Quench.040608153445.328	18644	21	-0.0042	8.63	HcoilHcoil	QTLRS2_QBLRS2	-0.0020	4.504	Quench, 20A/sec, 4.5K, Iq~18000A
sr02.Quench.040608160358.148	18899	20	-0.0039	8.71	WcoilIdot	QTLRS2_QBLRS2	-0.0021	4.517	Quench, Iq=18793A, 20A/sec, 4.5K
sr02.Quench.040608162423.257	18897	20	-0.0046	8.84	HcoilHcoil	QTLRS2_QBLRS2	-0.0025	4.514	Quench 12 Iq=18788 20A/sec, 4.5K
sr02.Quench.040608165229.596	18958	20	-0.0038	8.72	HcoilHcoil	QTLRS2_QBLRS2	-0.0021	4.507	Quench 12 Iq=18876 20A/sec ; 4.5K
sr02.Quench.040608171828.140	19025	20	-0.0041	8.70	HcoilHcoil	QTLRS2_QBLRS2	-0.0017	4.508	Quench 13 Iq=18938 20A/sec; 4.5K
sr02.Quench.040608174252.249	19321	20	-0.0034	8.70	WcoilIdot	QTLRS2_QBLRS2	0.0091	4.512	Quench 14 Iq=19236 20A/sec; 4.5K
sr02.Quench.040608180904.923	19389	19	-0.0140	12.77	SIWcoil	QTLRS2_QBLRS2	-0.0015	4.513	Quench 15 Iq=19321; 20A/sec; 4.5 K
sr02.Quench.040608183225.039	19169	21	-0.0038	8.72	HcoilHcoil	QTLRS2_QBLRS2	-0.0027	4.522	Quench 16, Iq=19075, 20A/sec; 4.5K
sr02.Quench.040608185452.273	19316	19	-0.0059	9.54	WcoilIdot	QTLRS2_QBLRS2	-0.0025	4.514	Quench 17 Iq=19204 20A/sec, 4.5K
sr02.Quench.040608191745.418	19564	21	-0.0036	8.85	HcoilHcoil	QTLRS2_QBLRS2	-0.0025	4.519	Quench 18 Iq=19464 20A/sec; 4.5K
sr02.Quench.040608205001.382	19487	19	-0.0074	10.30	WcoilGnd	QTLRS2_QBLRS2	-0.0020	4.499	Quench, Iq=19416A, 20A/sec, 4.5K
sr02.Quench.040608211534.265	19517	20	-0.4324	172.00	HcoilHcoil	QTLRS2_QBLRS2	0.0076	4.503	Quench, Iq=19408A, 20A/sec, 4.5K
sr02.Quench.040609091830.686	19670	20	-0.0038	9.00	HcoilHcoil	QTLRS2_QBLRS2	-0.0025	4.495	Quench, Iq=19597A, 20A/sec, 4.5K
sr02.Quench.040609094210.394	18986	20	-0.0136	12.25	HcoilHcoil	QTLRS2_QBLRS2	-0.0025	4.497	Quench, Iq=18879A, 20A/sec, 4.5K
sr02.Quench.040609100330.415	19604	21	-0.0038	8.98	HcoilHcoil	QTLRS2_QBLRS2	-0.0020	4.497	Quench 23 Iq=?; 20A/sec ; 4.5K
sr02.Quench.040609103644.556	19678	21	-0.0035	9.01	HcoilHcoil	QTLRS2_QBLRS2	-0.0018	4.494	Quench 24 Iq=19585, 20A/sec; 4.5K
sr02.Quench.040609111304.835	19497	21	-0.0041	9.01	HcoilHcoil	QTLRS2_QBLRS2	-0.0024	4.500	Quench 25 Iq=19384 20A/sec; 4.5K
sr02.Quench.040609113623.882	19875	20	-0.0038	9.13	HcoilHcoil	QTLRS2_QBLRS2	-0.0020	4.520	Quench 26 Iq=19778 20A/sec; 4.5K
sr02.Quench.040609120130.983	19821	20	-0.0038	9.02	WcoilIdot	QTLRS2_QBLRS2	-0.0022	4.520	Quench, Iq=19709A, 20A/sec, 4.5K

sr02.Quench.040609123105.006	19775	22	-0.0041	9.30	WcoilIdot	QTLRS2_QBLRS2	-0.0021	4.516	th quench, Iq~19kA, 20A/sec, 4.5K
sr02.Quench.040609131546.915	19949	21	-0.0032	8.91	HcoilHcoil	QTLRS2_QBLRS2	-0.0021	4.524	th quench, Iq=19877A, 20A/sec, 4.5K
sr02.Quench.040609141437.619	2535	19	-0.0043	0.14	GndRef	QBLRS2_QBLRS1	-0.0003	4.508	pped while ramping to 5,000 amps w/ master unit only
sr02.Quench.040609144036.763	3258	0	-0.0046	0.37	WcoilIdot	QTLRS2_QBLRS2	-0.0032	4.508	ned off power power supply and tripped ETS systemCoef
sr02.Quench.040609151831.476	5007	0	-0.0034	0.64	WcoilIdot	QTLRS2_QBLRS2	-0.0025	4.494	
sr02.Quench.040609154640.283	4660	301	-0.1865	4.64	HcoilHcoil	QTLRS1_QTLRS2	0.0281	4.499	th quench, Iq=4674A, 300A/s, 4.5K
sr02.Quench.040609155541.595	5881	200	-0.1360	5.50	HcoilHcoil	QTLRS2_QBLRS2	0.0028	4.513	st quench, Iq=5854A, 200A/sec, 4.5K
sr02.Quench.040609160725.164	17620	150	-0.0064	8.51	SIWcoil	QTLRS2_QBLRS2	-0.0025	4.529	ench 32 Iq=17531 150A/sec; 4.5K
sr02.Quench.040609161755.349	18837	100	-0.0073	9.53	HcoilHcoil	QTLRS2_QBLRS2	-0.0020	4.556	ench 33 Iq=18753; 100A/sec ; 4.5K
sr02.Quench.040609162652.500	18130	126	-0.0085	9.57	WcoilIdot	QTLRS1_QTLRS2	-0.0017	4.561	np 34 Iq=18045 125a/sec;4.5K
sr02.Quench.040609163303.915	6314	175	-0.0738	3.85	HcoilHcoil	QTLRS2_QBLRS2	0.0041	4.551	ench 35 Iq=6253 175A/sec; 4.5Kato
sr02.Quench.040609164232.229	18486	76	-0.0133	11.64	HcoilHcoil	QTLRS2_QBLRS2	-0.0028	4.596	ench 36 Iq=18... 75A/sec;4.5K
sr02.Quench.040609170639.877	19830	19	-0.0035	9.07	HcoilHcoil	QTLRS2_QBLRS2	-0.0013	4.583	ench 37; Iq=19720 20A/sec;4.5K
sr02.Quench.040609172701.766	19918	21	-0.0035	9.17	HcoilHcoil	QTLRS2_QBLRS2	-0.0018	4.594	ench 38 Iq=19801A 20A/sec;4.5K508
sr02.Quench.040609174815.977	19839	12	-0.0034	9.01	HcoilHcoil	QTLRS2_QBLRS2	-0.0024	4.602	ench 39 Iq=19733 20A/sec; 4.5K
sr02.Quench.040609181525.114	19977	20	-0.0032	9.05	HcoilHcoil	QTLRS2_QBLRS2	-0.0020	4.594	th quench,Iq=19871A, 20A/sec, 4.5K
sr02.Quench.040609182748.823	18875	50	-0.0130	11.80	HcoilHcoil	QTLRS2_QBLRS2	-0.0027	4.599	st quench, Iq~18000A, 50A/sec, 4.5K
sr02.Quench.040609183723.997	18194	136	-0.0127	11.03	WcoilIdot	QTLRS2_QBLRS2	-0.0022	4.581	ench 42 Iq=18106 137A/sec; 4.5K
sr02.Quench.040609190315.869	19950	20	-0.0035	9.18	WcoilIdot	QTLRS2_QBLRS2	-0.0021	4.585	rd quench, Iq=19833A, 20A/sec, 4.5K8
sr02.Quench.040609192617.295	20175	21	-0.0034	9.25	HcoilHcoil	QTLRS2_QBLRS2	-0.0020	4.602	ench 44 Iq=20060 20A/sec; 4.5K
sr02.Quench.040609194639.983	19147	20	-0.0139	12.50	HcoilHcoil	QTLRS2_QBLRS2	-0.0024	4.585	ench 45 Iq=19039 20A/sec; 4.5K~20
sr02.Quench.040609201122.053	20305	20	-0.0032	9.12	WcoilIdot	QTLRS2_QBLRS2	-0.0022	4.602	ench 46 Iq=20197 20A/sec; 4.5K
sr02.Quench.040609203622.493	20197	21	-0.0031	9.14	WcoilIdot	QTLRS2_QBLRS2	-0.0018	4.602	th quench, 20A/sec, 4.5K, Iq~20kA
sr02.Quench.040609210101.914	20195	19	-0.0034	9.14	HcoilHcoil	QTLRS2_QBLRS2	-0.0025	4.607	th quench, Iq=20089A, 20A/s, 4.5KCoef
sr02.Quench.040609212318.338	20338	19	-0.0045	9.68	SIWcoil	QTLRS2_QBLRS2	0.0092	4.595	th quench, 20A/s, 4.5K, Iq=20208A
sr02.Quench.040610111750.196	19056	18	-0.0056	9.42	WcoilIdot	QTLRS2_QBLRS2	-0.0031	2.160	ench 50 Iq=18984 ; 20A/sec; 2.15K
sr02.Quench.040610113938.566	18677	20	-0.0087	10.27	WcoilIdot	QTLRS2_QBLRS2	-0.0039	2.158	ench 51 Iq=18558A; 20A/sec, 2.15K
sr02.Quench.040610120408.176	19361	19	-0.0076	10.43	HcoilHcoil	QTLRS2_QBLRS2	-0.0038	2.153	ench 52 Iq=19245A, 20A/sec 2.15K
sr02.Quench.040610122414.154	18569	21	-0.0070	9.59	HcoilHcoil	QTLRS2_QBLRS2	-0.0042	2.155	ench 53 Iq=18469 20A/sec; 2.15K
sr02.Quench.040610124605.548	19077	20	-0.0192	14.38	WcoilGnd	QTLRS2_QBLRS2	-0.0031	2.154	ench 54 Iq=18973 ; 20A/sec; 2.15K
sr02.Quench.040610130658.930	18876	21	-0.0064	9.58	WcoilIdot	QTLRS2_QBLRS2	-0.0042	2.154	th quench, Iq=18776, 2.2K, 20A/sec
sr02.Quench.040610132612.496	18803	19	-0.0063	9.44	WcoilIdot	QTLRS2_QBLRS2	0.0097	2.155	th quench, Iq=18735A, 2.2K, 20A/sec

sr02.Quench.040610134538.592	19299	21	-0.0053	9.54	WcoilIdot	QTLRS2_QBLRS2	-0.0031	2.154	ench 57 Iq=1???? 20A/sec; 2.15K08
sr02.Quench.040610140551.151	18572	19	-0.0105	10.77	HcoilHcoil	QTLRS2_QBLRS2	-0.0036	2.154	ench 58 Iq=18457 20A/sec; 2.15K
sr02.Quench.040610142551.861	18976	19	-0.0060	9.52	WcoilIdot	QTLRS2_QBLRS2	-0.0028	2.154	ench 59 Iq=18911A 20A/sec: 2.15 K
sr02.Quench.040610144538.948	18818	21	-0.0073	9.82	WcoilIdot	QTLRS2_QBLRS2	0.0095	2.154	th quench, Iq=18740A, 2.2K, 20A/sec

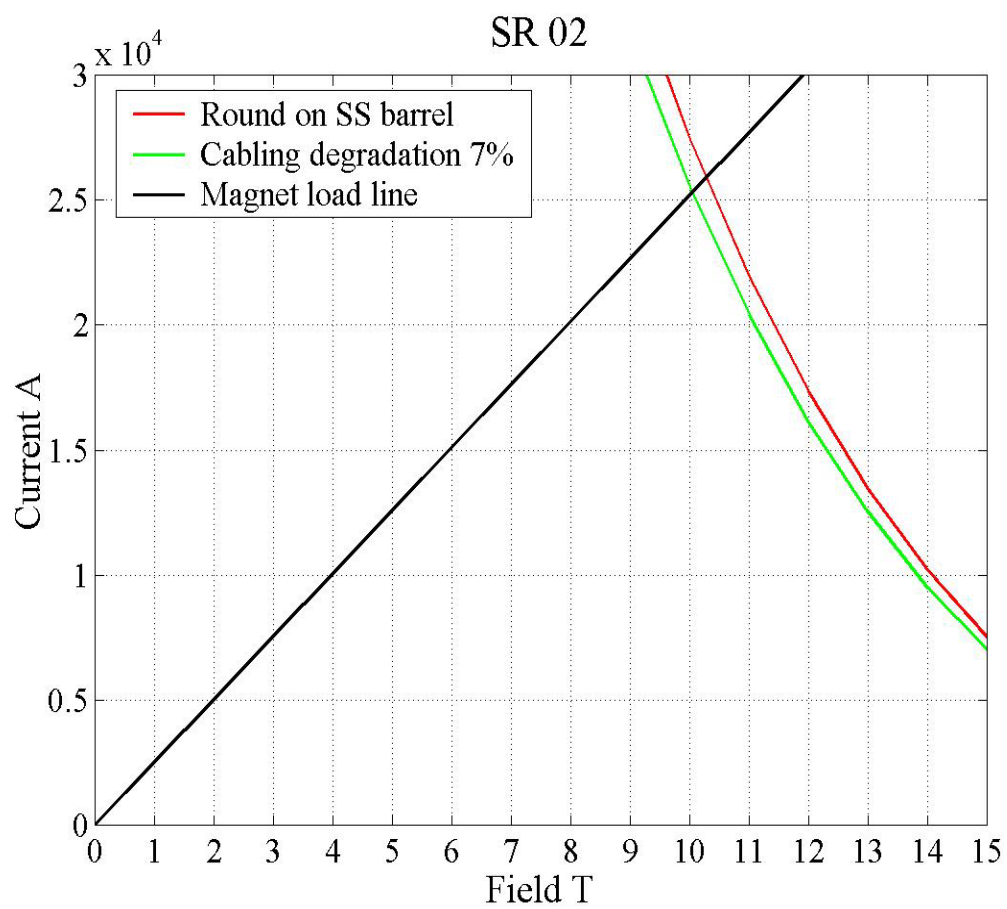


Fig.3. Sort sample limit calculation.

3. Ramp Rate Dependence

The default current ramp rate was 20 A/sec. Ramp rate dependence study at 4.5K is summarized in Figure 4. Quench current as a function of the ramp rate for SR02 was not a smooth curve. Also at about 175 A/s is exhibited a sharp drop of the quench current indicating that the cooling conditions are not optimal for this magnet relative to its AC losses.

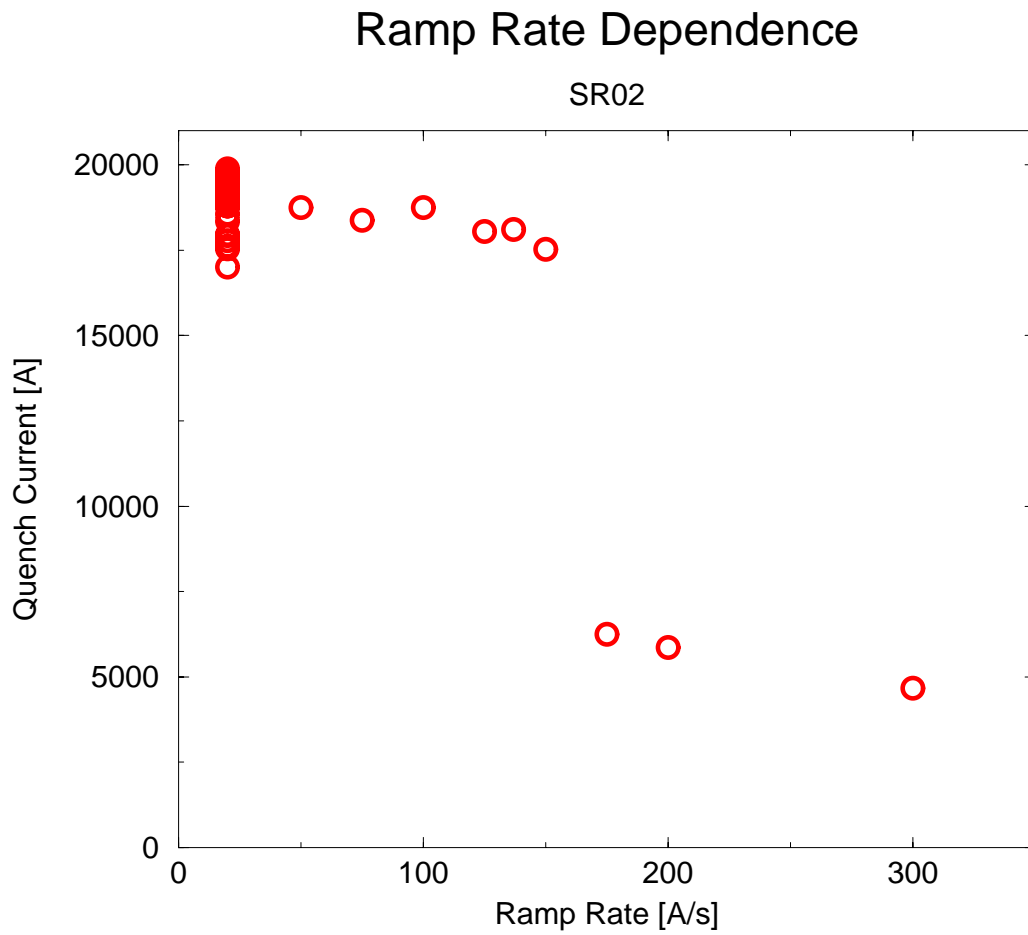


Figure 4. Current ramp rate dependence.

4. Splice measurement

We performed splice measurements. The voltage drops across the splices were recorded while the current was increased up to 16000 A and then decreased down to 0. Figure 5 shows the results of the measurements

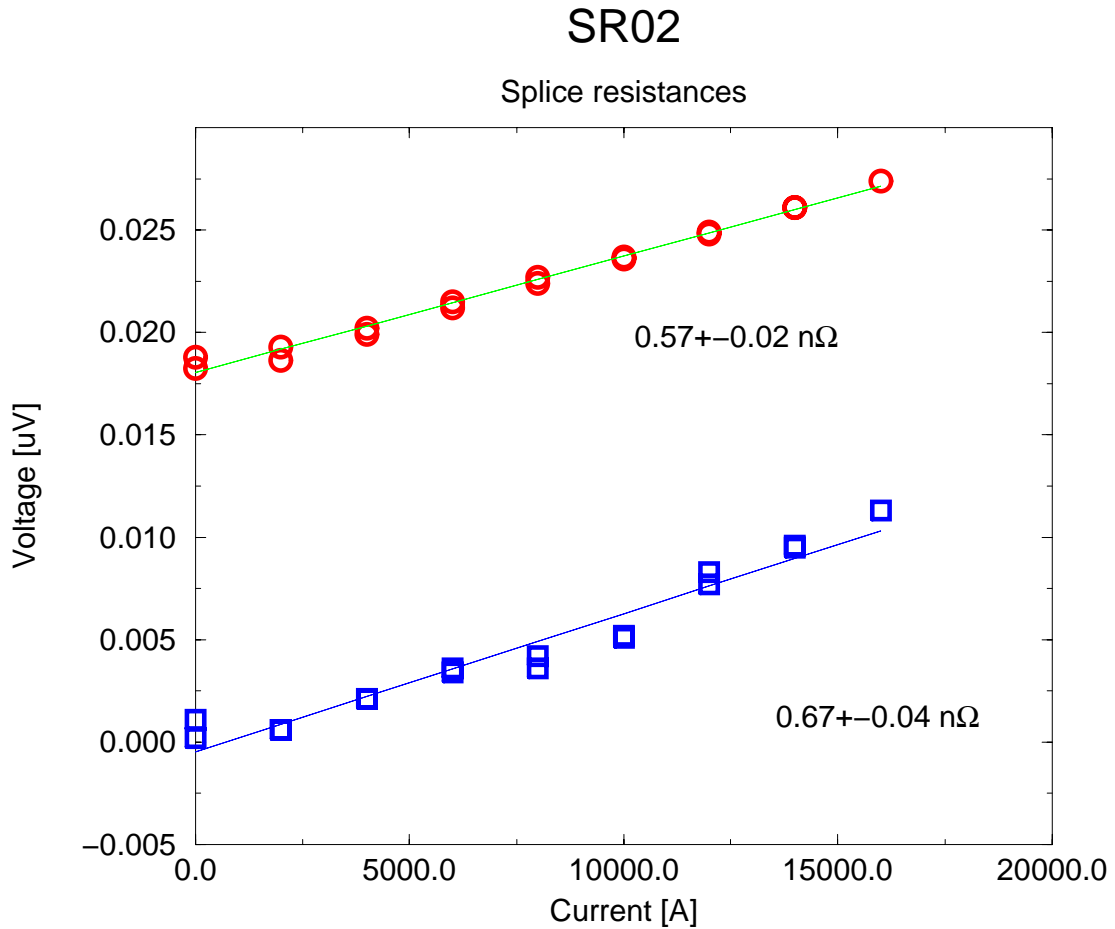


Figure 5. Splice measurement.

5. RRR measurement

The RRR measurement was performed between 03/17/2004 and 03/22/2004. The magnet was gradually warming up and meanwhile we recorded the whole coil voltage value generated by 10 A across the magnet.. The measured RRR value is 125.